

## Innovative Swirl Injector for LOX and Hydrocarbon Propellants, Phase I

Completed Technology Project (2007 - 2007)



## Project Introduction

Gases trapped in the propellant feed lines of space-based rocket engines due to cryogenic propellant boil-off or pressurant ingestion can result in poor combustion efficiencies, combustion instabilities, or long startup transients. To assist NASA in the use of the high performing liquid oxygen propellant combinations in space engines, IN Space proposes to investigate the feasibility of an innovative swirl injector design for liquid oxygen and hydrocarbon propellants to achieve high combustion efficiencies, stable operation, and short and smooth startup transients despite potential two-phase oxidizer flow. Additionally anticipated benefits of the injector include low inert mass and low manufacturing costs. IN Space plans to carry out the feasibility assessment of the injector design by conducting broad parametric test fire evaluations of a notional LOX/hydrocarbon workhorse thruster based on present NASA needs to assess the effects of several design considerations on the combustion efficiency, static combustion stability, and startup transient duration performance merits. A preliminary flightweight injector design will also be generated in order to compare the estimated injector mass with similar injector designs.

## Anticipated Benefits

Potential NASA Commercial Applications: Additional applications of innovative swirl injector design-based thrusters include serving as the turbopump gas generator for U.S. Air Force and space tourism/low cost space access LOX/hydrocarbon booster engines currently of interest for several different payload types, apogee boost/orbital transfer engines on satellites, and reaction control systems onboard civilian suborbital vehicles using LOX/hydrocarbon propellants for the main engine.



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

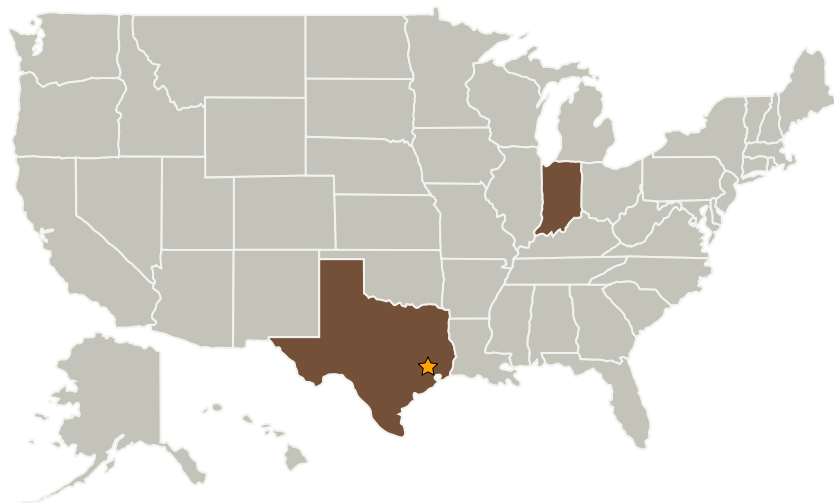
Small Business Innovation Research/Small Business Tech Transfer

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
IN Space, LLC	Supporting Organization	Industry	West Lafayette, Indiana

## Primary U.S. Work Locations

Indiana	Texas
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## Project Transitions

**January 2007:** Project Start**July 2007:** Closed out

**Closeout Summary:** Innovative Swirl Injector for LOX and Hydrocarbon Propellants, Phase I Project Image

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Benjamin L Austin

## Technology Areas

**Primary:**

- TX01 Propulsion Systems
  - ↳ TX01.1 Chemical Space Propulsion
  - ↳ TX01.1.2 Earth Storable